



PATENT

Customer No. 22,852

Attorney Docket No. 08513.7023-00000

UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

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Holmes et al.

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Group Art Unit: 1711

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Serial No.: 09/529,873

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Examiner: D. Truong

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Filed: July 27, 2000

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For: POLYMERIC MATERIALS FOR  
ELECTROLUMINESCENT  
DEVICES

)

Assistant Commissioner for Patents  
Washington, DC 20231

AF20/E  
7/23/02  
TC

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JUL 18 2002  
TC 1700

SUPPLEMENTAL RESPONSE FILED WITH RCE

Applicant wishes to correct minor typographical errors in claims 11 and 16 as follows:

EJ

11. (Amended) A compound according to claim 1, wherein the adjacent substituents are in the 2-position and the 3-position of the phenylene residue.

E2

16. (Amended) A method according to claim 14, wherein the base is potassium tertiary butoxide.

A copy of all claims following the amendment are attached for the convenience of the Examiner.

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In the Final Office Action mailed March 5, 2002, claim 13 is found allowable if rewritten in independent form. The remaining claims 1-7, 9, 11, 12, 14-24, 30 and 31 are rejected under section 103 as obvious over Antoniadis or Wan or Hsieh. Specifically, the examiner states that applicant's reliance on the claimed product being "soluble" cannot be given patentable weight because "soluble" is found in the preamble,

and secondly, because the compounds of the cited references allegedly have all of the claimed requirements, such compounds "inherently" must be soluble.

Applicant's response of May 6, 2002, amended independent claims 1 and 31 to move the word "soluble" from the preamble into the body of the claim. Furthermore, applicant submitted two publications supporting applicant's position that it was known in advance of any one of the cited references (Antoniadis or Wan or Hsieh) to be disadvantageous to utilize a 2-step precursor and subsequent thermal conversion process for applying conjugated polymers to substrates and, thus, if the polymers disclosed in Antoniadis or Wan or Hsieh were, in fact, soluble, they would not have been prepared by the precursor method as described in each of these references.

In contrast, applicant claims a "soluble film-forming" conjugated poly(1,4-arylene vinylene) compound having a 1,4-phenylene vinylene unit with "adjacent substituents" which are oriented to cause (produce) a blue-shift in the photoluminescence and/or electroluminescence of the compound. This combination of a "soluble film-forming" compound with a 1,4-phenylene vinylene unit, having adjacent substituents which are oriented to cause (produce) a blue-shift in the photoluminescence or electroluminescence of the compound, is not taught or suggested by any of the cited references.

In an Advisory Action mailed May 14, 2002, the examiner stated that the May 6, 2002 amendment would be entered upon filing of an appeal, but would not overcome the rejection for the reasons stated in the last office action and because applicant's arguments are not commensurate in scope with the claims.

On June 12, 2002, the undersigned attorney telephoned Examiner Truong, to discuss and clarify the Advisory Action. Examiner Truong identified the following questions following applicant's last response:

- How does applicant know the claimed compound is soluble?
- How is the claimed compound different from the compounds made by the cited prior art?
- How does one make a conjugated polymer having a 1,4-phenylene vinylene unit with 2,3 substitution?

Applicant is filing the present RCE with supplemental response in order to answer the examiner's questions and to request entry of the amendment filed May 6, 2002, which acts and should place the present application in condition for allowance.

#### Summary of Applicant's Argument

Applicant's claim 1 is directed only to compounds that have "adjacent substituents . . . oriented . . . to cause a blue-shift in the photoluminescence and/or electroluminescence of the compound", as well as the specified "soluble, film-forming" conjugated compound. Similarly, independent claim 31 has two requirements -- "adjacent substituents which produces blue-shifted electroluminescence or photoluminescence", and the "soluble, film-forming" conjugated polymer compound.

Applicant will now describe why, based on the teachings of the three cited references, the polymers prepared therein are not applicant's claimed compounds having these two requirements.

Applicant will, in the following paragraphs, first provide a general background concerning the present invention, followed by a discussion of the specific teachings of the cited references, followed by specific responses to each of the examiner's questions.

#### General Background to the present invention

This invention primarily is concerned with conjugated poly(1,4-arylene vinylene) compounds having a 1,4-phenylene vinylene unit where the substituents on the 1, 4-

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phenylene vinylene unit are oriented so as to affect the electronic structure of the compound and to cause a blue shift in the photoluminescence and/or electroluminescence of the compound. No information is given in the cited prior art that the orientation of the substituents as recited in applicant's claim 1 would affect the photoluminescence or electroluminescence of the claimed compound and, certainly, no information is given that this orientation would give a blue shift in the photoluminescence or electroluminescence.

Within the class of compounds described above, this invention is concerned particularly with those compounds within that class that are soluble. This is because soluble compounds have the enormous advantage that they can be processed in their final form rather than via a precursor which then requires thermal conversion (a 2-step process). A combination of factors will determine whether the compound is soluble, including the nature of each of the "adjacent substituents", the nature of further substituents on the phenylene vinylene unit, and the nature of any repeat units in the polymer backbone other than the phenylene vinylene unit.

Current claim 1 is directed only to compounds that fulfill the "adjacent substituent for blue shift" aspect of the present invention as well as the "soluble" aspect of the present invention.

**Wei, Antoniadis, Wan, Hsieh**

Each of these prior art documents discloses 2,3-DP-PPV made by the 2-step halogen precursor route. The polymers disclosed in these documents meet the "adjacent substituents for the blue shift" aspect of compounds according to applicant's claim 1. However, the combination of factors that affect solubility of the polymer are such that, in the case of 2,3-DP-PPV, the polymer is **insoluble**. As such, these polymers do not meet the "soluble" aspect of compounds according to claims 1 and 31.

Taking the disclosure of Antoniadis as an example of the halogen precursor route described in the prior art, the experimental section of Antoniadis describes the reaction of 1 equivalent (0.003 moles) of base to 1 equivalent of monomer 1 to eliminate a first equivalent of HCl and to provide soluble precursor 2. This precursor is deposited by spin coating and a second equivalent of HCl then is eliminated by heating to yield DP-PPV.

In contrast, example 2 of the present application describes the addition of 6 equivalents of base to one equivalent of monomer. This ensures that both equivalents of HCl are eliminated in one step to yield polymer 1. Example 3 of the present application then describes spin coating of this soluble polymer.

Clearly, the process of Antoniadis has to be in two steps because while the precursor is soluble, the compound itself is **insoluble**. If both equivalents of HCl were eliminated in the reaction mixture in Antoniadis, then insoluble DP-PPV would precipitate from the reaction mixture. It is for this reason that the experimental section in Antoniadis describes carefully a process where, in the first step, only one equivalent is eliminated from the monomer.

The addition of 1 equivalent of base is also described in example 6 of Hsieh; Wan (p. 6569, col. 2, second full paragraph); and Wei (bottom of col. 1 on p. 574).

### The Examiner's Questions

The Examiner's first question is "How does applicant know the claimed compound is soluble?"

As described above, a skilled person is able to make some assessment of solubility based on the identity of the compound backbone and substituents. For example, the skilled person may know that alkyl groups are solubilising, whereas, phenyl groups are not. More specifically, solubility can be determined by performing

polymerization -- here for example, using two equivalents of base in accordance with the present invention as explained above, and seeing whether an insoluble product comes out of solution.

As explained above, in Antoniadis, 1 equivalent of base is used to provide a soluble precursor; the skilled person knows that the precursor is soluble because the precursor does not come out of solution. The soluble precursor is not applicant's claimed compound. Rather, Antoniadis takes his soluble precursor and deposits it by spin coating and then applies heat and eliminates a second equivalent of HCl to yield DP-PPV; this is not applicant's claimed compound as it is an **insoluble** compound.

Wan and Hsieh describe a similar process as Antoniadis.

Thus, applicant has shown that, in fact, each of the prior references does not disclose applicant's claimed "soluble film-forming" conjugated polymer, but rather the references each disclose a soluble precursor, and an **insoluble** compound.

The examiner's next question concerns on what basis applicant contends the claimed compound is different from the compounds made by the cited prior art.

As described above, the claimed compounds must be **soluble**. If the combination of factors affecting solubility are such that they lead to a particular compound being insoluble, then such a compound would **not** fall within the scope of current claim 1 (or claim 31). As mentioned above, factors affecting solubility include the nature of each of the "adjacent substituents", and the nature of further substituents on the phenylene vinylene unit and the nature of any repeat units in the polymer backbone other than the phenylene vinylene unit.

Also, as mentioned above, the difference in solubility between compounds according to the present invention and the 2,3-DP-PPV known in the art has the consequence that these compounds are made by different processes. The **insoluble**

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2,3-DP-PPV known in the art, is made by a **2-step process** where one equivalent of HCl is eliminated from the monomer in the first step.

In answer to the third question, how can one achieve a 2,3 position substitution, this can be achieved in accordance with the present invention, and in the prior art, where this substitution pattern is present in the monomer. As described above, the solubility/insolubility of the compound is **not** determined only by the substitution pattern. In other words, two arylene vinylene compounds which include a phenylene vinylene unit having the same substitution pattern, do not necessarily have the same solubility characteristics. Rather, it is the combination of factors previously described which determine the solubility.

Applicant has established, based on the specific teachings of each of the three cited references, why they fail to teach or suggest applicant's compounds of claim 1 and claim 31. The rejected dependent claims should be allowable for at least the same reasons.

In view of the foregoing amendments and remarks, applicants respectfully request the reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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Dated: July 11, 2002

By   
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